

# ESA SSA Federated Approach for Space Weather Services

Juha-Pekka Luntama  
Alexi Glover  
Nicolas Bobrinsky

SSA Programme Office  
European Space Agency

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[www.esa.int](http://www.esa.int)

European Space Agency



# Purpose of the ESA SSA Programme



“The objective of the Space Situational Awareness (SSA) programme is to support the European independent utilisation of, and **access to, space** for research or services, through the **provision of timely and quality data**, information, services and knowledge regarding the **space environment**, the **threats** and the sustainable exploitation of the outer space **surrounding our planet Earth.**”

- **ESA Ministerial Council  
November 2008**



# ESA SSA SWE Segment Development

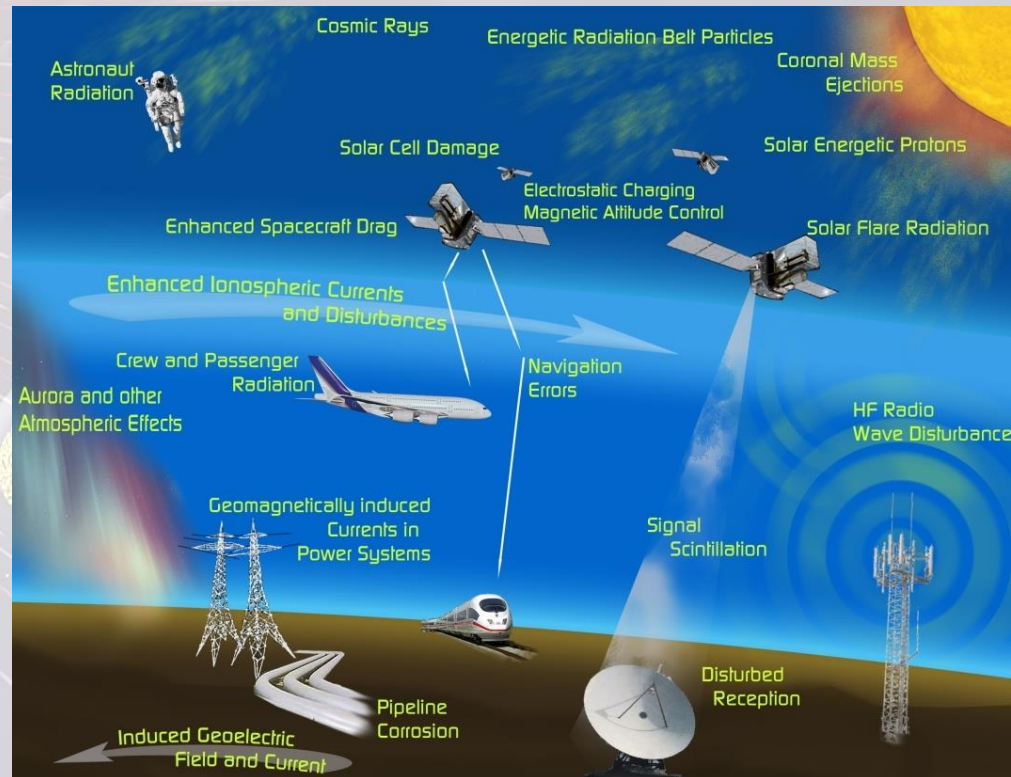


Mission Objective:

**Detection and forecasting of Space Weather events and their effects on European space assets and ground based infrastructure**

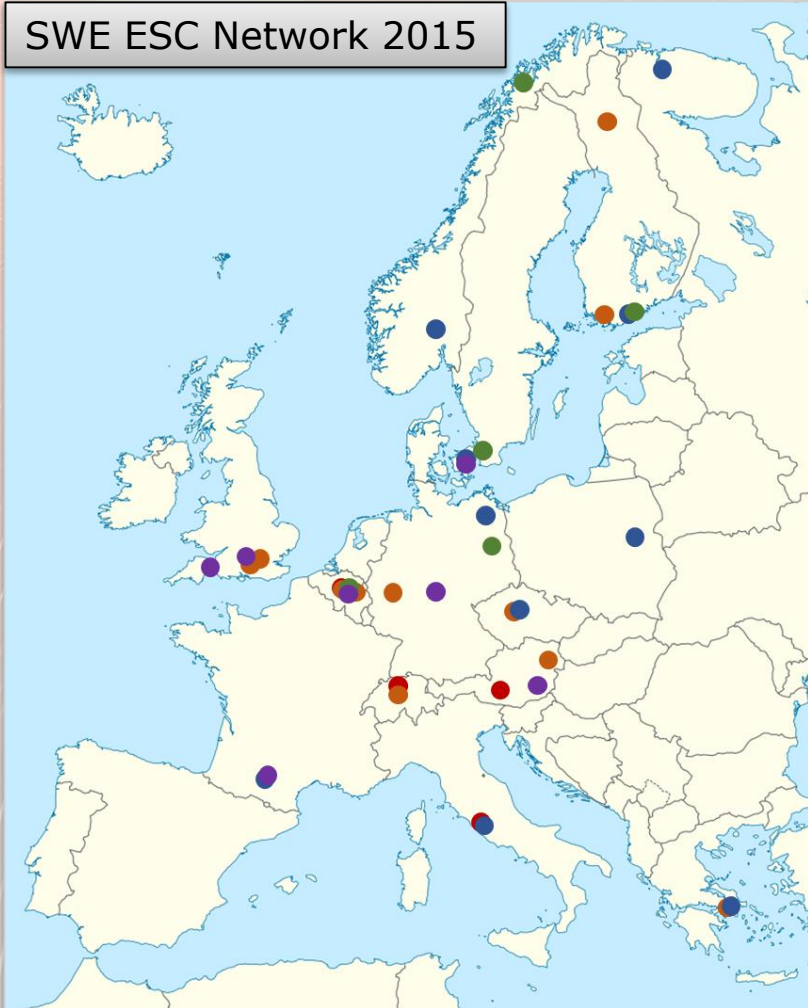
Development approach:

- Leveraging European SWE expertise
- Networking European SWE assets
- Advancing SWE service provision based on requirements from SSA customers & stakeholders



# Networking European SWE Assets

SWE ESC Network 2015



## Data archives

- SSA SWE Data Centre (Redu)
- Federated data repositories

## SSA SWE Coordination Centre

- User Helpdesk
- Space Pole, Belgium

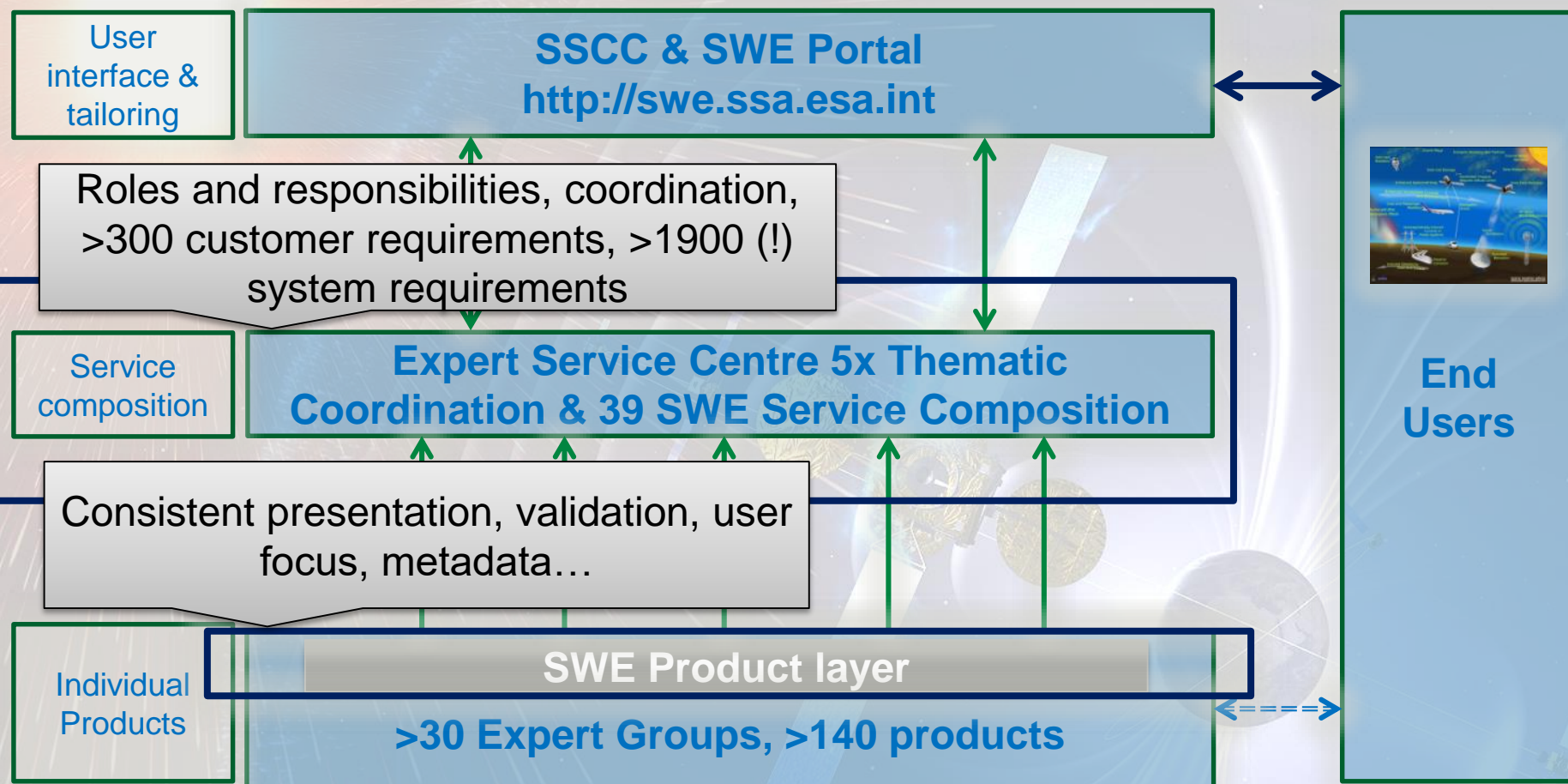
## SWE Expert Service Centres (ESCs)

Solar Weather	Ionospheric Weather	Space Radiation	Geomagnetic Conditions	Heliospheric Weather
European expert groups and centres of excellence				

## Sensor systems



# Structuring the Federated ESC Network



# SWE Targeted Developments

P2-SWE-II  
Services for SST  
users



SN-VI: Services for  
aviation, resource  
exploitation & data  
visualisation toolkit



P2-SWE-XIV: Virtual  
Space Weather  
Modelling Centre

**KU LEUVEN**

**Expert Service Centres Definition  
& Development  
P2-SWE-I**



P2-SWE-XIII  
Advanced  
prototypes:  
spacecraft  
operations

P2-SWE-XVI  
Utilisation of Swarm  
data for SWE  
services

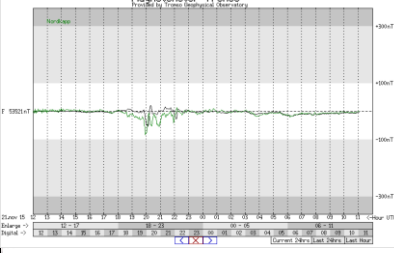
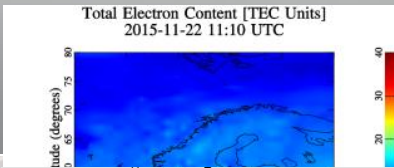
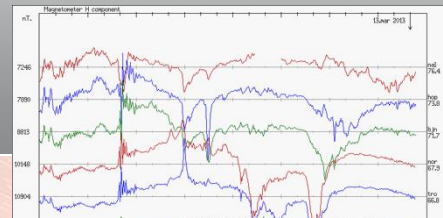


P2-SWE-XII  
Tailoring for Arctic  
Region users

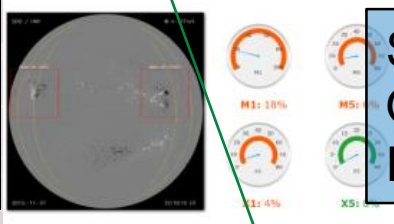
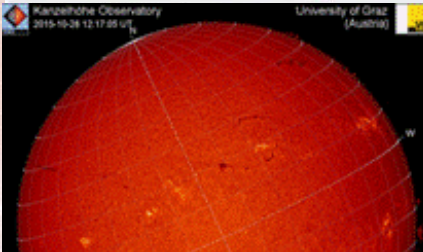
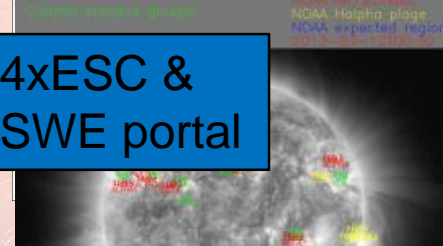


P2-SWE-XXIV  
Advanced  
geomagnetic  
services

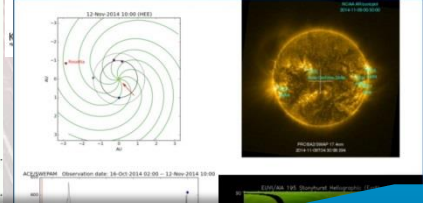
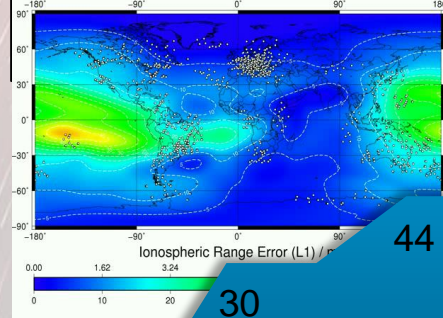
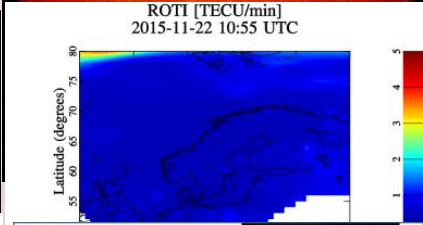
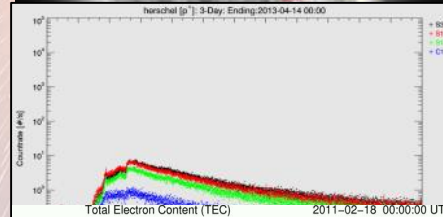
# SWE Network Product Growth



SWE-I pt2  
+ others



SWE-I pt1:  
Opening H-  
ESC



56 65

130 140

44

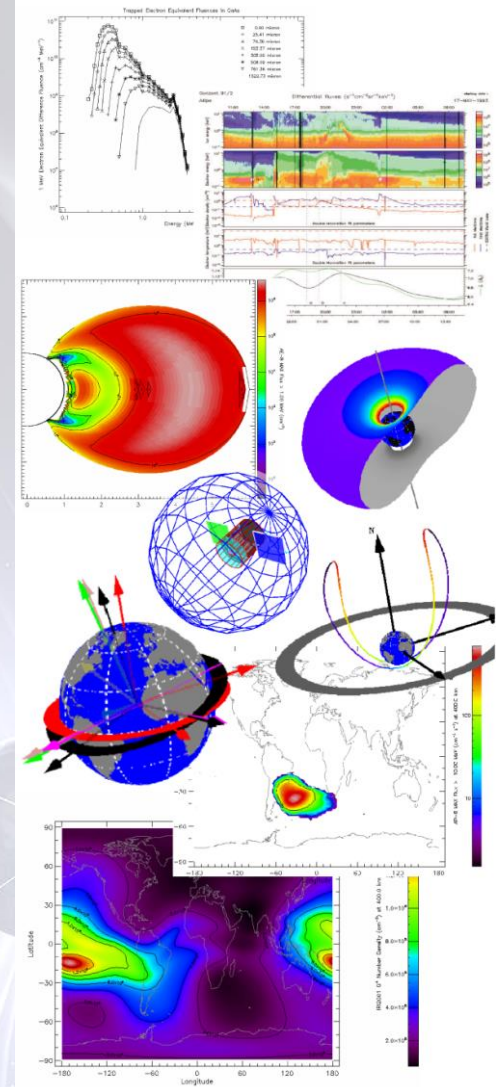
48

30

Mar... May... Jul... Sep... Nov... Jan... Mar... May... Jul... Sep... Nov... Jan... Mar... May... Jul... Sep... Nov... Jan... Mar... May... Jul... Sep... Nov...

SSCC operations

- Most forecast capability well below user thresholds
  - Accurate SWE forecasting is a key challenge
    - Required for effective mitigation of SWE hazard
    - “Understanding space weather to shield society: A global road map for 2015-2025 commissioned by COSPAR and ILWS”
    - SWE development roadmaps per service
  - SWE Segment activities will support targeted research including:
    - Model & tool development
    - Model validation and inter-comparison
  - Future R2O activities building on ESC experience in P2
- => Work closely with scientific community to improve SWE capabilities**



# ESA SSA SWE Approach for Geospace Monitoring

The background of the slide features a large, fiery sun on the left side, with bright orange and yellow flames. To the right, there are blue, swirling patterns representing magnetic field lines or plasma in space. Several small icons of satellites and space instruments are scattered across the right side, with some labeled 'EDRS-C' and 'GK2A'. A grey callout box is positioned in the lower right, containing a bulleted list of information about the Distributed SWE Sensor System (D3S).

EDRS-C

GK2A

- Distributed SWE Sensor System (D3S) utilising hosted payloads and SmallSats
- Coverage: LEO, MEO, GEO, HEO
- Instrument development in ESA Technology Programmes and SSA Programme
- Precursors: NGRM/EDRS-C, SOSMAG/GK2A

# Dedicated SSA SWE Space Missions to L-points



Solar monitoring data from Sun-Earth line + in-situ data from L1 are mandatory for SWE services

L1

**Collaboration and coordination with international partners:**

- ensured continued availability of L1 measurements
- Implementation of L5 mission

Data from L5 can substantially improve SWE forecasting capability

- Solar corona monitoring
- Heliospheric imaging
- Solar disc magnetic field
- EUV imaging
- In-situ measurements

L5

- ESA is developing a SWE system and associated services tailored for end users
- Approach based on federated services networking SWE assets in SSA Participating States
- Focus in 2017-2020 in
  - Targeted developments for improved models and tools, validation and inter-comparison
  - Developing new SWE instruments, with identification of hosted payload flight opportunities for geospace monitoring
  - Ensuring continued availability of critical SWE measurements outside the Earth's magnetosphere
- ESA seeking collaboration with international partners: specific interest in coordinating approaches to development of Lagrange missions (L1, L5)



**THANK YOU**

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